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**OSMOREGULATION IN ALGAE**

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*Abstract*

So far as is known, algae maintain a constant turgor with the osmotic pressure in their cells higher than the osmotic pressure of the surrounding fluid. This excess osmotic pressure seems to be held constant when the osmotic value of the water changes. In cases of low external osmotic pressure the elimination of water by contractile vacuoles provides some regulation of osmotic balance in fresh water algae whereas the assimilation or extrusion of special inorganic ions appears to play the chief part in this process in marine algae. (GUILLARD 1962). Especially the potassium ion is from special interest in this context as it is well documented to be a subject of energy dependent active transport in algae (GUTKNECHT 1968, ZIMMERMANN & STEUDLE 1971). Our present knowledge, however, on the biochemistry of ion transport systems unfortunately is rather limited.

More recently a few examples have been studied in which osmoregulation in algae occurs by accumulation or breakdown of low molecular weight carbohydrates, e.g. of glycerol in *Dunaliella parva* (BEN-AMOTZ & AVRON 1973) or isofloridoside (IF= $\alpha$ -galactosyl-1  $\rightarrow$  1-glycerol) in *Ochromonas malhamensis* (KAUSS 1967, 1969, SCHOBERT, UNTNER & KAUSS 1972). This offers simple model systems for studying the biophysical and biochemical steps involved in the regulation of osmotic balance, since the biochemistry and regulation of carbohydrate metabolism seems fairly well understood.

When substances raising the osmotic pressure, such as salts, glucose, mannitol, or polyethyleneglycol, are added to a suspension of *Ochromonas* the cells first shrink and then regain their volume because of the accumulation of IF in a concentration high enough to compensate directly for the outside stress. Any organic material such as exogenous glucose, photosynthesis products, or endogenous reserve polysaccharides can be used to produce IF. If the outside osmotic pressure is decreased, the osmotic excess of IF is converted to reserve  $\beta$ -1-3-glucans. Thus, the two carbohydrates seem to be readily interconvertible, and the direction of the conversion is determined by the osmotic value of the surrounding fluid (KAUSS 1967, 1969, SCHOBERT, UNTNER & KAUSS 1972). The formation and degradation of IF appears to involve the classical glycolytic reactions (KAUSS 1967) including a  $\beta$ -1-3-glucan phosphorylase (ALBRECHT & KAUSS). The key enzyme leading to IF is an UDP-gal: sn-glycero-3-phosphoric acid 1- $\alpha$ -galactosyl-transferase (KAUSS & SCHOBERT 1971). Physiological experiments suggest that the regulation involves activation of pre-existing enzyme molecules rather than *de novo* synthesis of enzymes (SCHOBERT, UNTNER & KAUSS 1972).

Chase experiments with glucose- $^{14}$ C indicate that the pool is in rapid turnover even at constant size. The turnover is related to the pool size. Regulation of the pool size seems to occur at enzymic steps involved in the formation, as well as those involved in the degradation of isofloridoside (KAUSS 1973).

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